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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/649,282	08/27/2003	Guo Liu	SMBZ 2 01002	5488
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CLEVELAND, OH 44114

EXAMINER

THOMPSON, CAMIE S

ART UNIT	PAPER NUMBER
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1794

MAIL DATE	DELIVERY MODE
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01/28/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/649,282	Applicant(s) LIU ET AL.	
	Examiner Camie S. Thompson	Art Unit 1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Amendment filed October 19, 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3 and 6-44 is/are pending in the application.
- 4a) Of the above claim(s) 32-41 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-31 and 42-44 is/are allowed.
- 6) ☒ Claim(s) 1,3 and 6-10 is/are rejected.
- 7) ☐ Claim(s) 11-20 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's amendment and accompanying remarks filed October 19, 2007 are acknowledged.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3 and 7-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukada, U.S. Patent Number 4,937,150.

Tsukada discloses an ultrafine grain fluorescent body comprising an ultrafine grain luminescent material such as ZnS containing an activator such as Eu (see reference claims 1-2). Additionally, the reference discloses that the grain size of the luminescent material from several hundred to several thousand angstroms (which is in the range of the crystal grain dimension of the present claims) and that the luminescent layer for an EL device comprising the fluorescent material, ZnS:Eu, has a thickness of 50 to 100 microns (see column 6, lines 3-19). The Tsukada reference does not disclose that the atomic ratio of the activator material to zinc is about 0.005 to 0.02. However, this is an optimizable feature. The atomic ratio of the activator material to zinc affects the luminescence of the fluorescent material. Discovery of optimum values of result effective variable involves only routine skill in the art *in re Boesch*, 617 F.2d 272 205 USPQ 215 (CCPA 1980). Therefore, it would have been obvious to one of ordinary skill in the art to have the

atomic ratio of the europium to the zinc be in the range of 0.005 to 0.02 in order to have a luminescent layer in an EL device have increased luminescence and brightness.

3. Claims 1 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukada, U.S. Patent Number 4,937,150 in view of Hampden-Smith, U.S. Patent Number 5,837,320.

Tsukada discloses an ultrafine grain fluorescent body comprising an ultrafine grain luminescent material such as ZnS containing an activator such as Eu (see reference claims 1-2). Additionally, the reference discloses that the grain size of the luminescent material from several hundred to several thousand angstroms (which is in the range of the crystal grain dimension of the present claims) and that the luminescent layer for an EL device comprising the fluorescent material, ZnS:Eu, has a thickness of 50 to 100 microns (see column 6, lines 3-19). The Tsukada reference does not disclose that the atomic ratio of the activator material to zinc is about 0.005 to 0.02.

However, this is an optimizable feature. The atomic ratio of the activator material to zinc affects the luminescence of the fluorescent material. Discovery of optimum values of result effective variable involves only routine skill in the art *in re Boesch*, 617 F.2d 272 205 USPQ 215 (CCPA 1980). Therefore, it would have been obvious to one of ordinary skill in the art to have the atomic ratio of the europium to the zinc be in the range of 0.005 to 0.02 in order to have a luminescent layer in an EL device have increased luminescence and brightness. Additionally, the Tsukada reference does not disclose that the fluorescent material is a sphalerite. The Hampden-Smith reference discloses ZnS thin films that have a sphalerite crystal structure (see column 17, lines 44-54). Additionally, the reference discloses that the typical films have a grain size around 60-100 nm. Also, Hampden-Smith discloses that the ZnS phosphor can be doped with europium or terbium (see reference claims 1, 18 and 20). It is disclosed in the reference that

zinc sulfide is deposited by chemical vapor deposition (see entire document). Sphalerite has a unique reflection. Therefore, it would have been obvious to one of ordinary skill in the art to use a sphalerite crystal structure in order to have a fluorescent material that has highly desirable properties due to the high orientation of the sphalerite crystal structure.

4. Claims 11-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The prior art does not teach or suggest the recited

electroluminescent device comprising the phosphor of claim 1, further including one or more of

- i) interface modifying layers on one or both sides of the phosphor film to improve the stability of the interface between the phosphor and the rest of the device;
- ii) a hermetic enclosure for the electroluminescent device; and
- iii) an oxygen getter incorporated into the device.

5. Claims 21-31 and 42-44 are allowed. The prior art does not provide for a thick film dielectric electroluminescent device comprising:

a thin phosphor layer of formula ZnS:Re , wherein said phosphor layer has a crystal grain size of up to about 50 nm and Re is selected from terbium and europium; and

a structure and/or substance to minimize or prevent reaction of the fine grained phosphor with oxygen, wherein said structure or substance comprises one or more of;

- i) interface modifying layers on one or both sides of the phosphor film to improve the stability of the interface between the phosphor and the rest of the device;
- ii) a hermetic enclosure for the electroluminescent device; and

iii) an oxygen getter incorporated into the device.

Additionally, the prior art does not provide for a thick film dielectric electroluminescent device comprising:

A 0.5 to 1.0 μm thick phosphor layer of formula ZnS:Re , wherein said phosphor layer has a sphalerite crystal structure with a crystal grain size of up to about 50 nm and Re is selected from terbium or europium; and

i) interface modifying layers on one or both sides of the phosphor film to improve the stability of the interface between the phosphor film and the rest of the device, wherein said interface modifying layers are comprised of pure zinc sulfide or silicon nitride.


Response to Arguments

6. Applicant's arguments with respect to the instant claims have been considered but are not persuasive. Applicant argues that the present claims are drawn to a phosphor comprising a thin film of a rare earth activated zinc sulfide phosphor. Applicant argues that the applied reference does not teach or disclose a thin film. As for present claim 1, the range of the thin film is not explicitly set forth. Additionally, the claims are drawn to the phosphor. The Tsukada reference discloses a luminescent layer comprising a rare earth activated zinc sulfide with the grain size being in the same range as required by the present claims. Although the Tsukada reference does not disclose the atomic ratio of activator material to the zinc, this is an optimizable feature. The Tsukada reference discloses that light emission is dependent upon excitation of the activator material. Therefore, it would have been obvious to have the atomic ratio of the activator in the

range of 0.005 to 0.02 to have improved luminescence. The Tsukada reference is not without motivation. Applicant argues that the combination of the Tsukada and Hampden-Smith reference fails to teach or suggest the invention by the recited claims. Tsukada does not disclose that the crystal structure is sphalerite. Hampden-smith was brought in to show that sphalerite can be used in a zinc sulfide phosphor with terbium or europium as the activator. Additionally, the Hampden-smith reference discloses a grain size for the phosphor in the same range as required by the present claims. The sphalerite crystals have a unique reflection in order to provide higher luminescence. The combination is not without motivation. The rejections are maintained.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Camie S. Thompson whose telephone number is (571) 272-1530. The examiner can normally be reached on Monday through Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Terrel Morris, can be reached at (571) 272-1478. The fax phone number for the Group is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


/Arti Singh/
Primary Patent Examiner 1794
1/20/05